June 19, 1962 S. J. MIKINA 3,039,676

MOTION CONVERTING APPARATUS

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FIG.1.

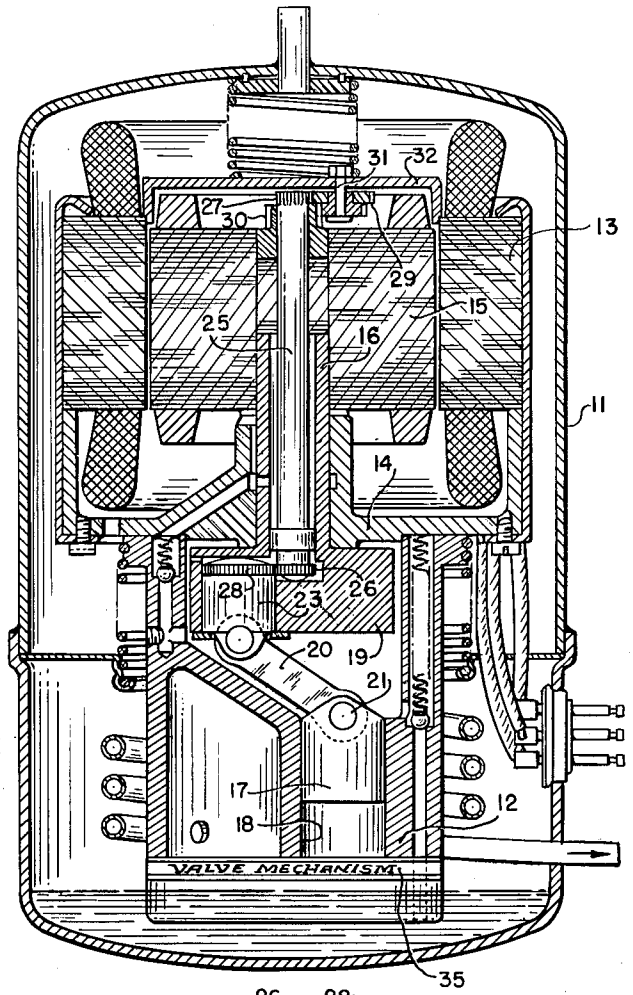
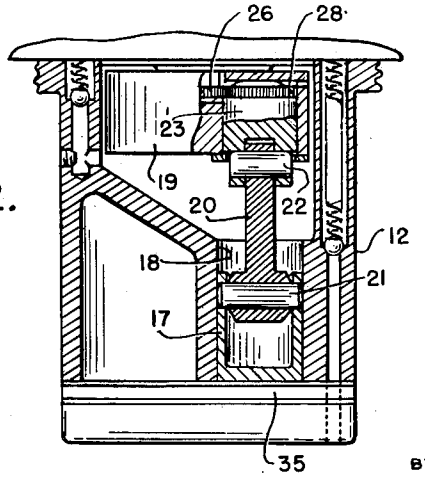



FIG.2.




INVENTOR
STANLEY J. MIKINA
BY William J. Daley
ATTORNEY

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FIG. 3.

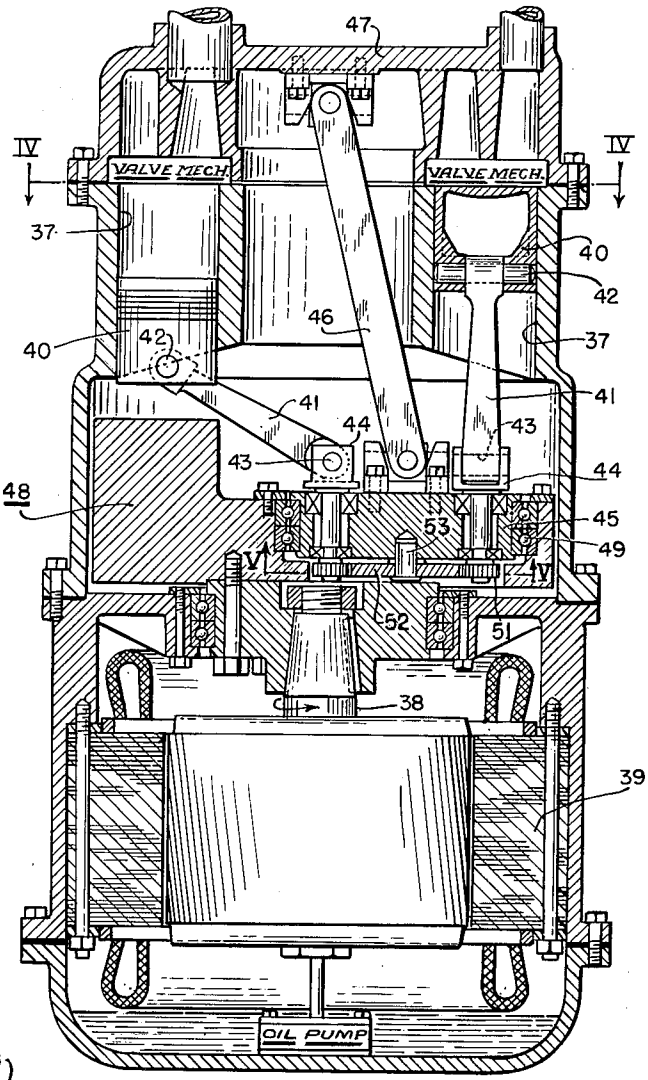
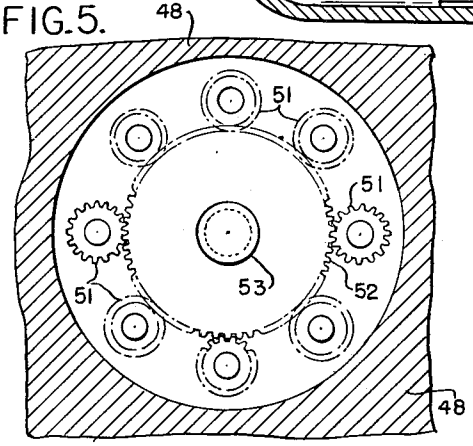



FIG. 5.



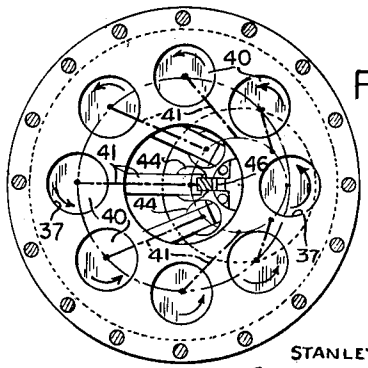




FIG. 4.

INVENTOR
STANLEY J. MIKINA
BY William J. Foley
ATTORNEY

June 19, 1962 S. J. MIKINA 3,039,676

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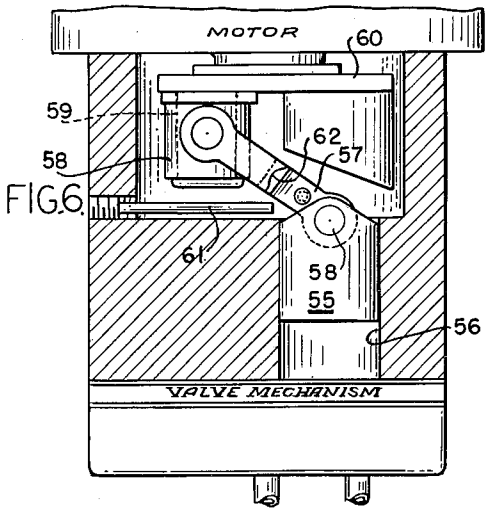



FIG.6.

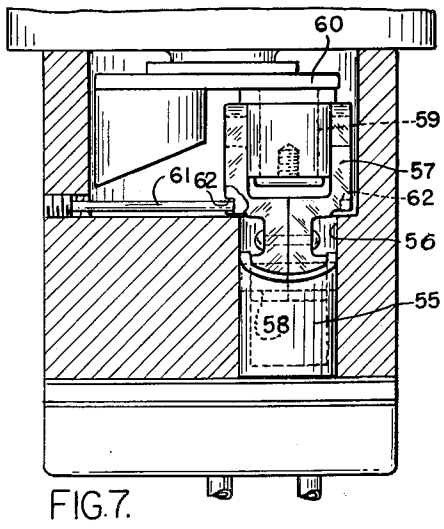



FIG.7.

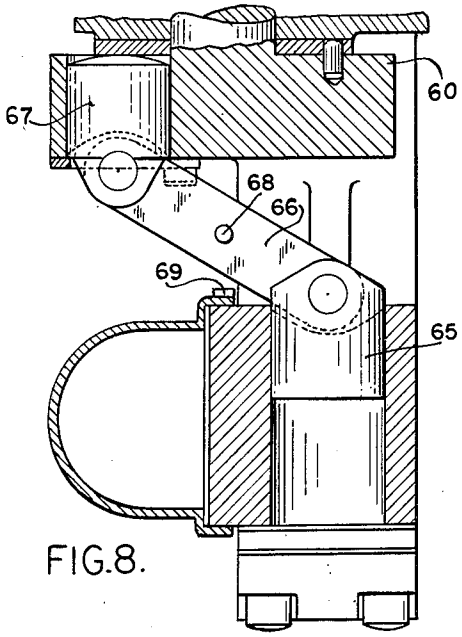



FIG.8.

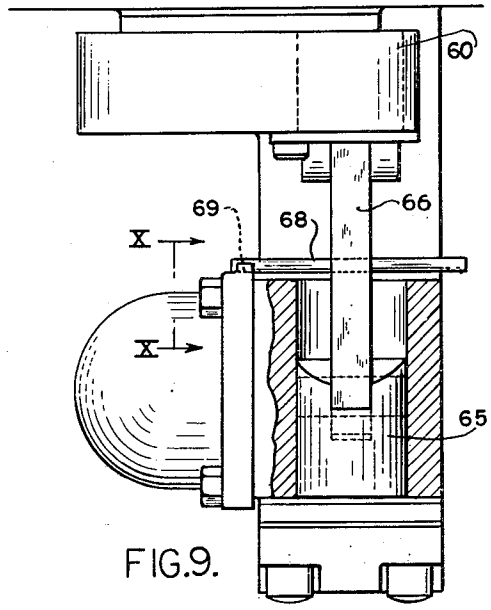



FIG.9.

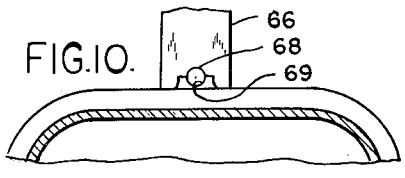



FIG.10.

INVENTOR
STANLEY J. MIKINA
BY William J. Foley
ATTORNEY

United States Patent Office 3,039,676 Patented June 19, 1962



3,039,676

# MOTION CONVERTING APPARATUS

Stanley J. Mikina, Penn Hills, Pa., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Filed Jan. 9, 1959, Ser. No. 785,896
7 Claims. (Cl. 230—173)

This invention relates to apparatus for converting rotary motion to reciprocating motion along a line parallel, or substantially so, to the axis of rotation of the driving element. This apparatus finds particular usefulness in motor driven compressors, such as refrigerant compressors, wherein it is desired to convert rotary motion of a motor driven shaft to reciprocating motion of a piston within a cylinder.

It has previously been recognized that certain advantages, particularly compactness, attend a motor-compressor unit having one or more reciprocating pistons which move in cylinders that are arranged substantially parallel to the axis of the driving motor shaft. These units are sometimes referred to as "axial compressors." Such units can be made smaller in transverse dimensions than the more conventional motor-compressor units in which the piston moves at right angles to the axis of the motor shaft.

This invention is particularly applicable to so-called "axial compressors" in which rotary movement of a crank or eccentric carried by the motor shaft is transmitted to a piston that is rotatably and axially movable in a cylinder by means of a connecting rod that is pivotally connected to the piston but restrained against rotation relative the piston. This type of driving connection causes the piston to rotate in its cylinder as the drive shaft is rotated. The invention is more particularly concerned with a motor-compressor unit of this type which is further characterized by having the axis of the cylinder offset from the center, or axis, of rotation of the crank end of the connecting rod by a distance equal to the radius of movement of the crank end of the connecting rod. Apparatus which is so characterized has been discovered by the inventor to possess certain advantages which contribute to efficient and reliable operation. For example, the piston in such apparatus is caused to rotate in its cylinder with a constant angular velocity equal to one-half the angular velocity of the driving shaft. This uniform rotation of the piston promotes the formation of a film of lubricant between the piston and its cylinder and also makes the wear producing load of the piston on the cylinder more uniform. Maintaining a constant angular velocity of the piston in its cylinder also reduces the fluctuating loads imposed on other elements of the motion converting system between the motor and the piston.

While these advantages may have been noted by previous designers, they were heretofore regarded as being impossible to obtain because of the following problem, which is inherently associated with axial type compressors which are characterized in the above mentioned manner. This problem is brought about by an ambiguous geometric relation between the several elements of the motion converting system which exists when the crank end of the connecting rod is aligned with the axis of the cylinder. At all other positions of the crank end of the connecting rod in its path of movement, the position of the piston in its cylinder is positively determined, but when the crank end of the connecting rod is in line with the axis of the cylinder, and the piston is at its dead center position, the piston is free to rotate in its cylinder with disastrous results, such as breaking the components of the system as the crank end of the connecting rod is moved beyond the said aligned position.

Prior designers have avoided this "locking" problem by



purposely designing the compressor in such a manner that the offset distance between the axis of the cylinder and the center of rotation of the crank end of the connecting rod is either less than or greater than the radius of movement of this end of the connecting rod. In doing so they accepted, respectively, variable velocity oscillating movement of the piston within its cylinder or variable velocity rotation of the piston within its cylinder at an average speed equal to the speed of rotation of the motor shaft; either of which consequences is undesirable from the standpoint of efficient and reliable operation and from the standpoint of noise generated by the compressor.

This invention eliminates the possibility of the elements of the motion converting system becoming locked in the dead center position, or attitude, of the system and, therefore, enables the more efficient arrangement to be employed. Specifically, the invention provides means for ensuring that the piston and the connecting rod therefor continue to rotate at one-half the angular velocity of the driving shaft as the piston is moved through its dead center position and, furthermore, for limiting or controlling the positions which the piston may occupy in its dead center position, so that the system cannot be placed in a locked condition even if the components thereof are stopped with the crank end of the connecting rod aligned with the axis of the cylinder and thereafter subjected to forces tending to misalign the system.

Several specific devices for performing the above-described function of the anti-locking means are described in the detail description of the invention which follows. This description will also bring out additional objects, advantages and features of the invention.

In the drawings, which form a part hereof:

FIG. 1 is a vertical sectional view of a motor-compressor unit embodying this invention;

FIG. 2 is a fragmentary view of the compressor portion of the unit shown in FIG. 1 and illustrating different operating positions of the elements of the compressor;

FIG. 3 is a vertical sectional view of a multi-cylinder motor-compressor unit utilizing another embodiment of the invention;

FIG. 4 is a horizontal sectional view on a reduced scale of the compressor shown in FIG. 3 and is taken through the top of the cylinder as indicated by the line IV—IV in FIG. 3;

FIG. 5 is an enlarged detailed sectional view taken as indicated by the line V—V in FIG. 3;

FIG. 6 is a vertical sectional view through the compressor of a unit utilizing another embodiment of this invention;

FIG. 7 is a view similar to FIG. 6 but showing the elements of the compressor in different operating positions;

FIG. 8 is a vertical sectional view through another unit employing a further embodiment of the invention;

FIG. 9 is a view similar to FIG. 8 but showing the elements of the compressor in other operating positions; and

FIG. 10 is a detailed view taken as indicated by the line X—X in FIG. 9.

The motor-compressor unit illustrated in FIGS. 1 and 2 is resiliently mounted within a casing **11** and comprises a cylinder block **12** and a motor **13** which are connected by means of a frame **14**. The motor **13** includes a rotor **15** which is carried by and imparts rotary movement to a hollow shaft **16**. Rotary movement of the shaft **16** is converted to reciprocating movement of a piston **17** mounted for rotation and axial reciprocation within a bore, or cylinder **18** in block **12**. The cylinder **18** has its axis disposed substantially parallel to and offset from the axis of the motor shaft **16**.

The system of mechanical connection between the shaft **16** and the piston **17** includes a crank rotor **19**, secured

to the lower end of the motor shaft, and a connecting rod 20. One end of the connecting rod 20 is pivotally connected to the piston 17 by means of a wrist pin 21 which restrains the connecting rod from rotation with respect to the piston 17. The opposite, or crank, end of the connecting rod 20 is connected by means of another wrist pin 22 to a crank pin 23, which is rotatably carried by the crank rotor 19 eccentrically of the axis of the shaft 16. It can be readily appreciated that rotation of the crank rotor 19 moves the crank end of the connecting rod 20 in a circular path of movement about an axis that is aligned with the axis of motor shaft 16. In accordance with this invention, the radius of this path of movement of the crank end of the connecting rod 20 is equal to the distance by which the axis of the cylinder 18 is displaced from the axis of movement of the crank end of the connecting rod. Maintenance of this geometrical relationship between the several components of the motion converting system results in the piston 17 being rotated at a uniform angular velocity equal to one-half the angular velocity with which the motor shaft 16 is rotated.

This geometrical relationship also results in there being one position in the path of movement of the crank end of the connecting rod 20 in which the connecting rod is aligned with the axis of the cylinder 18 (see FIG. 2). When the crank rotor 19, the connecting rod 20 and the piston 17 are in this aligned position—the bottom dead center position of the piston 17—the piston 17 must occupy one of two rotative positions (180° apart) with respect to the cylinder block 12. In both of these positions the wrist pin 21, connecting the piston 17 and the connecting rod 20, is radially disposed with respect to the axis about which the crank end of the connecting rod is moved (this being the same as the axis of the motor shaft 16 in the unit of FIGS. 1 and 2). Should the piston 17 and connecting rod 20 become turned away from either of these positions while the piston is in this dead center position the system becomes locked against movement or, if the crank rotor 19 is turned under this condition, breakage of parts is likely to result. To insure that this locked condition is never permitted to come about, this invention provides means for positively controlling the rotative position of the piston 17 and the connecting rod 20 when these elements are in or passing through this dead center position.

The anti-locking means takes the form of a mechanical connection between the piston, the connecting rod, and another component of the motor-compressor unit with respect to which the piston is rotatable. In the unit illustrated in FIGS. 1 and 2, gear means are employed to positively relate turning movement of the piston 17 to movement of the motor shaft 16. The anti-locking means includes a concentric shaft 25 disposed within motor shaft 16 and having gears 26 and 27 respectively carried at the lower and upper ends thereof. The lower gear 26 meshes with gear teeth 28 provided in the periphery of the crank pin 23 to which connecting rod 20 is connected. The shaft 25 is caused to rotate relative the motor shaft 16 by a dual gear 29, which meshes with the gear 27 on the upper end of the concentric shaft 25 and with a gear plug 30 pressed into or otherwise secured to the upper end of the motor rotor 15. The dual gear 29 is supported for rotation by a stationary pivot pin 31 secured to a cap, or end bell, 32 which is stationarily supported by the stator portion of the motor 14.

Rotation of the motor rotor 15 drives the concentric shaft 25 through gears 30, 29 and 27, and rotation of shaft 25 is transmitted through gears 26 and 28 to the crank pin 23. The ratio of these several gears is so chosen as to produce an angular velocity of the crank pin 23, and consequently of connecting rod 20 and piston rod 17, that is equal to one-half the angular velocity of motor shaft 16. This positive driving connection between the shaft 16 and the piston 17 insures that the piston will occupy its proper rotative position within cylinder 18 even when the piston is stopped in its dead center position. Moreover, in passing through this dead center position, the piston 17 is positively driven so as to offset any tendency for the piston to slow its rotative speed as a result of friction between the piston and the cylinder or as a result of friction between the crank pin 23 and the crank rotor 19.

The flow of fluid into and from the cylinder 18 is controlled by a suitable valve mechanism indicated generally by the reference numeral 35. This mechanism is not shown, nor will it be described, because valve mechanisms suitable for this application have been devised in the past and are well known and well understood by those skilled in the art. The valve mechanism 35 forms no part of the present invention and the omission of details thereof simplifies this description of the invention.

FIGS. 3, 4 and 5 illustrate another embodiment of this invention applied to a multi-cylinder motor-compressor unit in which the cylinders, identified by numeral 37, are disposed annularly about the axis of a shaft 38 extending from a motor 39 which drives the compressor. Each cylinder 37 has a piston 40 mounted for axial and rotary movement therein. Each piston 40 has a connecting rod 41 connected thereto by means of a wrist pin 42 which permits pivotal movement of the connecting rod with respect to the piston but prevents relative rotation between the two. The opposite, or crank, end of each connecting rod 41 is pivotally connected by means of a wrist pin 43 to a crank pin 44. The several crank pins 44 are annularly disposed in a drive plate 45 and are mounted in suitable bearings to permit rotation thereof with respect to the drive plate. The drive plate 45 is prevented from rotating by a torque bar 46 which is universally connected at one end to the drive plate 45 and at its other end to a stationary portion of the motor-compressor frame or casing 47. Reciprocation of the pistons 40 is accomplished by translation of the drive plate 45 in a circular path disposed normal to the axes of the cylinders 37. This translating movement of the drive plate 45 is imparted thereto by a crank member 48 which is secured to the motor shaft 38 and in which the drive plate 45 is eccentrically mounted. Bearings 49 between the drive plate 45 and the crank 48 permit free turning movement of the crank 48 about the drive plate 45.

As in the case of the motor-compressor unit illustrated in FIGS. 1 and 2, the motion converting system of the unit illustrated in FIG. 3 converts rotary movement of the motor shaft 38 to reciprocating movement of the pistons 40 along lines that are substantially parallel to the axis of the motor shaft. In accordance with the invention, the crank end of each connecting rod 41 is moved through a circular path of movement, the radius of which is equal to the amount by which the axis of the cylinder for its piston is displaced from the axis about which this end of the connecting rod is moved. Again, then, each connecting rod 41 passes through one position in which its crank end is aligned with the axis of the cylinder 37 in which its piston moves. This relationship results in each of the pistons 40 being rotated in its cylinder 37 at an angular velocity which is equal to one-half the angular velocity of the crank end of its connecting rod 41 (see FIG. 4).

Following the principles of this invention, the motor-compressor unit of FIGS. 3 to 5 embodies means for insuring that the piston-connecting rod assemblies will pass through their respective dead-center positions without moving or drifting to a locked attitude. As in the case of the previously described embodiment of the invention, this means includes a system of gears for positively relating rotary movement of each piston 40 to another component of the unit with respect to which it is rotatable. Because each of the pistons 40 is rotating within its cylinder 37 with a constant angular velocity equal to the angular velocity of every other piston and because only one piston is in its dead center position at a time, it is

possible to control, or limit, the positions of the dead center piston by reference to positions of the other pistons. This is accomplished by means of a gear cluster carried by the drive plate **45** and comprising a plurality of pinions **51**, each of which is secured to one of the crank pins **44** and meshes with a central gear **52** that is rotatable about a stud **53** (see FIG. 5). The central gear **52** interconnects the several piston **40**-connecting rod **41** assemblies through the pinions **51** to which they are connected and causes positive related movement of each piston **40** with respect to every other piston. Thus, when one of the pistons **40** is in its dead center position, i.e. the crank end of its connecting rod **41** is aligned with the axis of the cylinder for that piston, its rotative position in its cylinder is determined by the positions of the other pistons **40**, which are positively located by virtue of the geometry of their drive systems. The effect is the same whether the piston be merely passing through its dead center position or is stopped in this position.

*Embodiments of Figs. 6 to 10*

The compressors illustrated in FIGS. 6 through 10 are also of the "axial" type, in which the crank end of the connecting rod is rotated in a circular path of movement that is normal to the axis of the cylinder and has a radius equal to the amount by which the axis of the cylinder is displaced from the axis of movement of that end of the connecting rod. These two embodiments also incorporate means for preventing the motion converting system from becoming locked when the piston is in its upper dead center position. In a sense, gear means similar in function to the positive drive gear means of the embodiments of FIGS. 1 to 5 are employed as anti-locking means, although they function to positively control the position of the piston and its connecting rod only when the piston is in or is passing through its dead center position.

Referring to FIGS. 6 and 7, this compressor includes a piston **55** which is mounted for reciprocal and rotary movement in a cylinder **56**. Motion is imparted to the piston **55** by means of a connecting rod **57** which has one end thereof connected to the piston by a wrist pin **58**. The opposite, or crank, end of the connecting rod **57** is pivotally connected to a sleeve **58** rotatably carried by a crank pin **59**, which is eccentrically mounted on a motor-driven crank plate **60**. Positive positioning of the piston **55** within its cylinder **56** is insured by a pin **61** stationarily mounted on the cylinder block and having an end portion thereof receivable within one or the other of two recesses **62** on opposite side edges of the connecting rod **57**. The surface configurations of the engaging portions of pin **61** and recesses **62** can be viewed as meshing gear tooth means, which are so located as to be in engagement as the piston **55** and connecting rod **57** are passing through their dead center positions to positively position the piston with respect to the cylinder **56** and insure its continued rotation at a velocity equal to one-half the angular velocity of the crank pin **59**. In order to prevent meshing loads and noise due to slight interference between the pin **61** and the groove **62**, the pin **61** preferably is made in the form of an elastic beam, the engaging portion of which can deflect slightly under load.

The embodiment illustrated in FIGS. 8 through 10 is similar in many respects to the embodiment of FIGS. 6 and 7 except that the positions of the elastic pin and the gear-like groove with which it meshes are reversed. In this embodiment, a reciprocating piston **65** is moved by a connecting rod **66**, the crank end of which is connected to a crank pin **67** which is moved in a circular path. The connecting rod **66** has an elastic pin **68** mounted thereon which has end portions projecting transversely from the connecting rod in a manner to engage a positioning groove **69** formed in a member which is attached to the cylinder in which the piston **65** moves. The pin **68** and groove **69** are located relative one another in such a manner that one



end of the pin **68** enters the groove **69** each time the piston **65** is moved through its dead center position. (See FIGS. 9 and 10.) The interengagement of the pin **68** and groove **69** prevents the piston **65** from moving or drifting from the rotative position thereof which must be maintained in order to prevent the motion converting system of the compressor from becoming locked.

From the foregoing it will be apparent this invention enables an axial type motor-compressor unit to be constructed with the elements of the motion converting system thereof arranged so as to insure quiet and efficient operation and long wear. Arranging the components of such units in a manner to promote uniform rotation of the piston in its cylinder at one-half angular velocity of the driving shaft was, heretofore, not considered feasible because of the locking problem inherent in such arrangements. This invention solves this problem and offers a basic concept or approach which can be utilized in a number of different ways as evidenced by the several embodiments of the invention herein disclosed.

It should be apparent that the principles of this invention, while particularly applicable to motor-compressor units where compactness and efficiency of operation are desirable attributes, may be applied to motion converting systems for other devices. For example, the principles are applicable to motion converting systems for reciprocating, internal combustion engines, wherein it is necessary to convert reciprocating movement of a piston to rotary movement of a work shaft. There are also numerous other devices requiring systems for converting rotary motion to reciprocating motion and vice versa.

Therefore, while but four specific embodiments of the invention are disclosed herein, it is to be understood that the invention is not limited thereto but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. In a compressor, the combination of a cylinder, a piston mounted in said cylinder for reciprocation and rotation therein, a connecting rod having one end thereof pivotally connected to said piston for movement about an axis at right angles to the axis of said cylinder and restrained against rotation with respect to said piston other than about the first mentioned axis, means for moving the opposite end of said connecting rod at a constant angular velocity in a circular path disposed substantially normal to, and extending through, the axis of said cylinder, so that there is one position in said path of movement in which said opposite end of said connecting rod is aligned with the axis of said cylinder, said opposite end of the connecting rod and the means for moving the same being rotatable relative to each other about an axis parallel to said cylinder axis, whereby said piston is caused to rotate in said cylinder at a constant angular velocity equal to one-half the angular velocity of said opposite end of said connecting rod and the rotative position of said piston in said cylinder is positively determined except when said connecting rod is in said one position, a member connected to said connecting rod for rotation therewith, and means acting on said member at least when said connecting rod is in said one position to maintain the axis of pivotal movement of said connecting rod with respect to said piston in radial relation to the axis about which said opposite end of the connecting rod is moved when said connecting rod is in said one position.

2. In a compressor, a shaft rotatable about its axis, a cylinder having its axis disposed substantially parallel to the axis of said shaft, a piston rotatably and axially movable in said cylinder, a connecting rod having one end thereof pivotally connected to said piston and restrained against rotation with respect to said piston, crank means connecting the opposite end of said connecting rod to said shaft for rotating said opposite end of said connecting rod in a circular path about an axis which is displaced from the axis of said cylinder by a distance sub-

stantially equal to the radius of said circular path, and means controlling the rotative position of said piston in said cylinder when said opposite end of said connecting rod is aligned with the axis of said cylinder, said means comprising first gear tooth means connected to said piston for rotation at the same angular velocity as said piston and second gear tooth means carried by another portion of the compressor with respect to which said piston is rotatable and engaging said first gear tooth means at least when said opposite end of the connecting rod is aligned with the axis of said cylinder to maintain the axis of pivotal connection between said piston and said connecting rod radial with respect to the axis of said shaft when said opposite end of the connecting rod is aligned with the axis of said cylinder.

3. In a compressor, a shaft rotatable about its axis, a cylinder having its axis disposed substantially parallel to and offset from the axis of said shaft, a piston rotatably and axially movable in said cylinder, a connecting rod having one end thereof pivotally connected to said piston and restrained against rotation with respect to said piston, crank means connecting the opposite end of said connecting rod to said shaft for rotation therewith, said opposite end of said connecting rod being radially spaced from the axis of said shaft a distance substantially equal to the offset distance between the axis of said shaft and the axis of said cylinder, and means controlling the rotative position of said piston in said cylinder when said opposite end of said connecting rod is aligned with the axis of said cylinder, said means comprising first gear tooth means connected to said piston for rotation at the same angular velocity as said piston and second gear tooth means carried by another portion of the compressor with respect to which said piston is rotatable and engaging said first gear tooth means at least when said opposite end of the connecting rod is aligned with the axis of said cylinder to maintain the axis of pivotal connection between said piston and said connecting rod radial with respect to the axis of said shaft when said opposite end of the connecting rod is aligned with the axis of said cylinder.

4. In a compressor, a shaft rotatable about its axis, a plurality of cylinders having their axes disposed substantially parallel to and annularly arranged about the axis of said shaft, a piston rotatably and axially movable in each of said cylinders, a connecting rod for each of said pistons, each connecting rod having one end thereof pivotally connected to its piston and retrained against rotation with respect to its piston, crank means connecting the opposite end of each of said connecting rods to said shaft for rotation therewith, said crank means effecting movement of said opposite end of each connecting rod in a circular path about an axis which is displaced from the axis of the cylinder with which it is associated by a distance substantially equal to the radius of said circular path, a pinion connected to said opposite end of each of said connecting rods for rotation therewith, and a gear rotatably carried by said crank means, said gear meshing with each of said pinions and preventing independent rotation of the connecting rods with respect to one another, whereby all of said pistons are caused to rotate at the same angular velocity when said shaft is rotated.

5. In a device for converting rotary motion to reciprocating motion, the combination of a cylinder, a piston mounted in said cylinder for reciprocation and rotation therein, a connecting rod pivoted at one end to said piston and restrained against rotation with respect to said piston, means for moving the opposite end of said connecting rod at a constant angular velocity in a circular path disposed substantially normal to the axis of said cylinder and about an axis which is displaced from said cylinder by a distance substantially equal to the radius of said circular path, a first member carried by said connecting rod for movement therewith, a second member stationarily mounted in said device, said first and second members being engageable with each other when said connecting rod is moving through the position in which its said opposite end is aligned with the axis of said cylinder and limiting the rotative positions of said piston with respect to said cylinder when said opposite end of said connecting rod is aligned with said cylinder axis.

6. In a device for converting rotary motion to reciprocating motion, the combination of a cylinder, a piston mounted in said cylinder for reciprocation and rotation therein, a connecting rod pivoted at one end to said piston and restrained against rotation with respect to said piston, means for moving the opposite end of said connecting rod at a constant angular velocity in a circular path disposed substantially normal to the axis of said cylinder, there being one position in said path of movement in which said opposite end of said connecting rod is aligned with the axis of said cylinder, a first member carried by said connecting rod for movement therewith, a second member stationarily mounted with respect to said cylinder, said first and second members being engageable with each other and limiting the rotative positions of said piston with respect to said cylinder when said opposite end of said connecting rod is in said one position.

7. In a device for converting rotary motion to reciprocating motion, the combination of a cylinder, a piston mounted in said cylinder for reciprocation and rotation therein, a connecting rod pivoted at one end to said piston and restrained against rotation with respect to said piston, means for moving the opposite end of said connecting rod at a constant angular velocity in a circular path disposed substantially normal to the axis of said cylinder, there being one position in said path of movement in which said opposite end of said connecting rod is aligned with the axis of said cylinder, a first member carried by said connecting rod for movement therewith, a second member stationarily mounted with respect to said cylinder, said first and second members being engageable with each other and limiting the rotative positions of said piston with respect to said cylinder when said opposite end of said connecting rod is in said one position, at least one of said members being resiliently constructed to permit the portion thereof which engages the other of said members to resiliently deflect upon misaligned engagement of said members.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,018,379 | Seward | Feb. 20, 1912 |
| 2,188,630 | Grahman | Jan. 30, 1940 |
| 2,360,876 | Huid | Oct. 24, 1944 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 564,161 | France | Dec. 22, 1923 |
| 730,893 | France | Aug. 25, 1932 |